THE PHOTOGRAPHS OF NOVA PERSEI.

REFERENCE has already been made in NATURE to the important photographs of the nebula associated with Nova Persei obtained by Mr. Ritchey at the Yerkes Observatory with the 2-foot reflecting telescope, the exposure being four hours. The *Astrophysical Journal*

FIG. 1.—The Yerkes Photograph, September 20.

for October contains an enlarged (five diameters) copy of the photograph and a diagram made from the original negative, which are now reproduced.

Still more recently the results secured at the Lick Observatory by Mr. Perrine with the Crossley 3-foot reflector with an exposure of more than seven hours, which were telegraphed over in the first instance, have now reached us in some detail. The communication (*Bulletin* No. 10) is accompanied by a diagram which shows remarkable changes of position in the more pronounced condensations. This diagram is referred to as follows:—

"The four masses of nebulosity are designated by the letters A, B, C, D; the positions which the centres of figure occupied on September 20, as shown in the reproduction from Mr. Ritchey's photograph, are occupied by the left-hand or north-west end of each of the short lines; the positions on November 7–8 are occupied by the right-hand or south-east ends of the lines.

"The line drawn between these positions for each condensation indicates the direction and amount of motion in the interval of forty-eight days. Condensation A is much the best adapted for accurate measurement, from its greater strength and from its forked appearance; condensations B and C are not quite so good for measurement as A, but still are very determinate; but while condensation D is the brightest of all, it is large, and so near the image of the Nova as to make its amount and direction of motion somewhat uncertain.

"It will be seen that the displacements agree well and amount to about $1\frac{1}{2}'$. The directions are not so consistent and could perhaps be explained by irregular motions in the nebulous mass, by a general translation of the nebula in one direction or by a spiral motion. It is certain, however, that the motion is not radial.

"The amount of motion is almost incredible, being no less than at the rate of 11′ per year. The greatest displacement (proper motion) in the stellar universe, so far observed, is less than 9″ per annum."

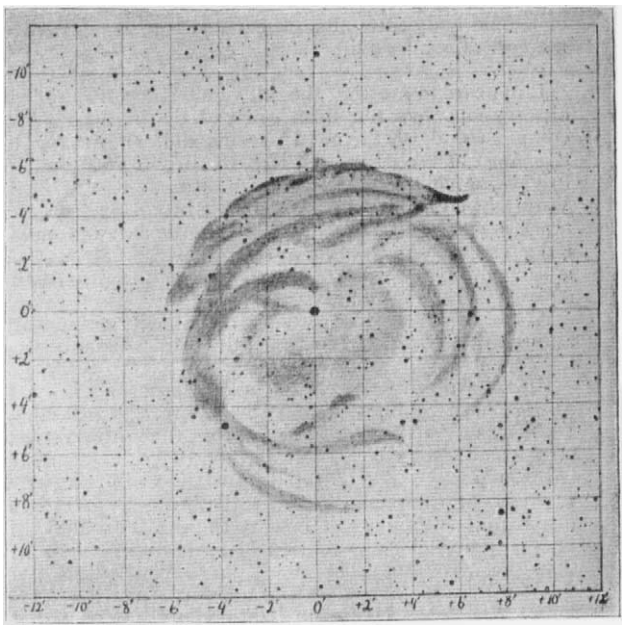

FIG. 2.—Drawing showing details and condensations.

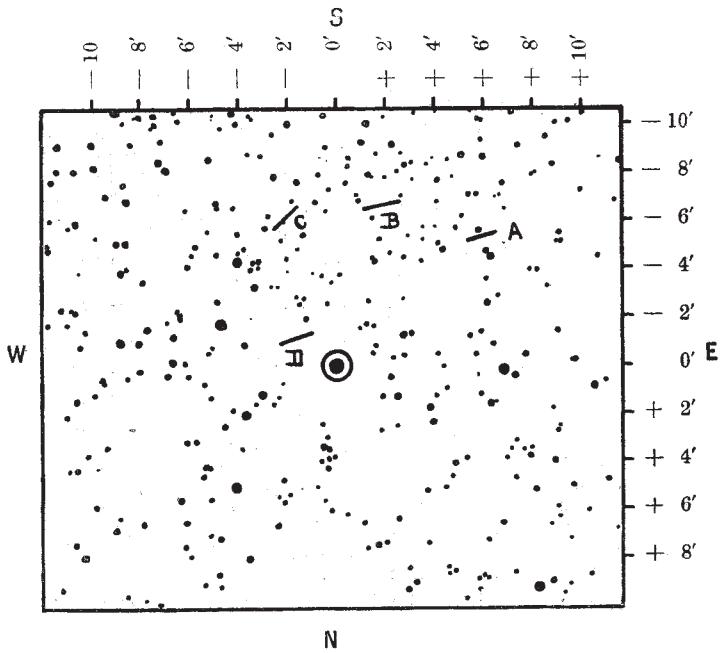

FIG. 3.—Diagram showing changes in position in the condensations as determined by the later observations at the Lick Observatory on November 7–8.

The note then goes on, "such an exceptional velocity as is here indicated leaves little doubt of the intimate connection of this nebulous matter with the Nova and its outburst. It is, perhaps, too soon to say just what bearing the foregoing observations will have upon the explanation

of the phenomena connected with new stars. It would seem, however, that such great velocities pointed rather to a violent collision of some sort than to an outburst within a dark and comparatively cool body; but whether a collision of a solid body with another, or the passage of a solid body through a gaseous nebula or a swarm of meteorites is uncertain."

It appears to me that the full significance of the recent observations has not been grasped by those who have commented upon them. It seems difficult to imagine that most of the new stars, like the bright-line stars and bright-line nebulæ, are *not* at the distance of the Milky Way as well as in its plane. If this be so, then this distance is enormous. Let us assume—the assumption is a moderate one—that it is represented by a parallax of half a second, and see how it works out on the two-minute squares marked in the diagrams.

At the Nova situated at such a distance, 1 minute of arc represents about 120 times the sun's distance from the earth.

The apparent movement of the condensations is stated to have been 1½ minutes in 48 days, say, approximately, 1 minute in a month, say, again, four times the distance of the sun in a day.

I do not say that such rapid translations of masses of matter are impossible, certainly there are no precedents for them; but my point is that there is absolutely no necessity for the assumption of such movements, and that the apparent change of position of these condensations can be explained otherwise than by movement. Indeed, such an explanation is not hard to seek when the meteoritic theory of new stars is closely considered in all its aspects. It is a well-known fact that the majority of new stars that have been recorded in more modern times, when the spectroscope has been available for their study, have ended by becoming nebulæ. The meteoritic theory explains the appearance of a new star by the interpenetration of two or more swarms of meteorites, a nebula being the representative of an ordinary great swarm, a comet near the sun being a representative of a small one disturbed by tidal action. The appearance of a new star is produced by the luminosity depending upon the celestial clashing. It is not difficult to conceive a system of several swarms of meteorites all performing their individual orbits, and so long as no two systems collide, the whole system will be invisible; but should a collision occur they will at once become visible, and the more violent the collision the brighter will be the light and the greater will be the luminosity of the "new star" which makes its appearance to chronicle the event.

Now suppose a nebula invaded, not by one, but by many swarms, under such conditions that the collision effects vary very greatly in intensity. In the present case the most violent one we began to know about some months ago; it constitutes Nova Persei. The least violent ones occurring in other parts of the disturbed nebula, almost immeasurably removed, *i.e.* more than 700 solar distances away, we only learn of from the recent photographs. The disturbances they chronicle are so feeble that to see the effect of them 7 hours' exposure with a 3-foot reflector are necessary, hence they soon die out; while they are dying other disturbances in other parts of the nebula arise. There is probably, therefore, no question of motion from place to place, we are dealing simply with different disturbances occurring in different places.

It is impossible to think that the great nebula which has now been photographed while the new star is still in being did not exist there a few months ago; and it is important, further, to remark that the nebulous matter already photographed in the region round the Nova is very probably only a portion of the actual amount of matter existing there, and that if the disturbances continue, more of the remaining portion may become visible. This, in fact, seems already to have been established, for Ritchey found later that the nebula "seems expanding in all directions." At the same time it may be stated that Campbell notes that the condensation D has remained unchanged, while there has been a further "movement" in the case of A and B, the "movement" of C being doubtful. There seems little doubt that later photographs will throw light on this question, but a matter to be regretted in this connection is that no photographs are available for the period during which the well-marked variability of the Nova was observed. These occasional outbursts of light were, we can now imagine, due to other disturbances of the nebula intermediate in intensity between that which caused the Nova itself and the other exceedingly faint ones now being photographed.

One important conclusion can, at any rate, be deduced from the Lick photographs, and that is that such explanations as explosions on solid globes, worlds on fire, volcanic eruptions, &c., must be considered less probable now that a great nebula is shown to be associated with many disturbances of very varying intensities. Formerly we had to wait for the death of a new star before the appearance indicating the existence of a nebula was manifested, and hence arose the idea that a star changed into a nebula, thus reversing the ordinary process of evolution.

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NOTES.

THE four Nobel prizes were distributed at Stockholm on Tuesday evening before a distinguished audience, among whom were the Crown Prince and other members of the Royal family o Sweden. Each prize was of the value of 200,000 francs. The prize for medicine was awarded to Dr. E. A. Behring, the prize for chemistry to Prof. J. H. van 't Hoff, the prize for physics to Prof. W. K. Röntgen, and the prize for literature to M. Sully Prudhomme.

IT is officially announced that the Board of Admiralty have received with much regret the resignation by Sir William H. White, K.C.B., F.R.S., in consequence of ill-health, of the appointment of Director of Naval Construction, which he has filled since 1885 with great distinction. They have appointed as his successor Mr. Philip Watts, F.R.S., who has held during the same time the post of director of the war shipbuilding department of Messrs. Sir William Armstrong, Whitworth and Co., Ltd., and naval architect to the company. Mr. Watts has done much original scientific and experimental work in connection with investigations of the stability of ships and floating bodies, the oscillations of ships in still water and amongst waves, and the propulsion and manœuvring powers of ships.

THE Berlin correspondent of the *Times* states that the estimates for the German Army include a vote for the new military technical college which the Government will open in the course of next year. The necessity for some such institution has been impressed upon the military authorities by the advancing scientific requirements of modern warfare, which are now too numerous and too varied to be provided for adequately by the resources at the command of the existing Staff College. There are branches of technical knowledge which, although they cannot strictly be classed as military, are nevertheless indispensable for the soldier. Among such subjects are steam-power, electricity, mechanics, the construction of boats and bridges, and the establishment of means of communication. In recognition